DEFENSE INFORMATION SYSTEMS AGENCY
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IN REPLY REFER TO: Joint Interoperability Test Command (JTE) **27 Mar 09**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Dell PowerVault MD3000 Storage Array Running the Modular Disk Storage Manager Version 03.35.G6.37 and Controller Firmware Version 07.35.22.60 for Internet Protocol Version 6 Capability

References: (a) DoDD 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01E, "Interoperability and Supportability of Information Technology and National Security Systems," 15 December 2008
(c) through (h), see Enclosure 1

1. References (a) and (b) establish the Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The Dell PowerVault MD3000 storage array running the Modular Disk Storage Manager (MDSM) Version 03.35.G6.37 and Controller Firmware (CFW) Version 07.35.22.60 met the Internet Protocol (IP) Version 6 (IPv6) Capable interoperability requirements of a Network Appliance as described in the Department of Defense (DoD) Information Technology Standards Registry, "DoD IPv6 Standard Profiles for IPv6 Capable Products Version 2.0," 1 August 2007, reference (c). The Dell PowerVault MD3000 storage array running the MDSM Version 03.35.G6.37 and CFW Version 07.35.22.60 has successfully completed the related IPv6 Interoperability portions of the "DoD IPv6 Generic Test Plan (GTP) Version 3," August 2007, reference (d), and is certified for listing on the Unified Capabilities (UC) Approved Products List (APL) as IPv6 Capable. This certification expires upon changes that could affect interoperability, but no later than 4 years from the date of this memorandum.

3. This special certification is based upon IPv6 Capable Interoperability testing conducted by JITC at Fort Huachuca, Arizona, and the vendor's Letter of Compliance (LoC) dated 2 July 2008. Interoperability testing commenced from 2 through 6 February 2009, at JITC's Advanced IP Technology Capability. Conformance testing was confirmed by Dell, and was verified in the LoC provided. Enclosure 2 documents the summary test results and describes the device. Users should verify interoperability before deploying the device in an environment that varies significantly from that described.

4. The device's interoperability status summary is in Table 1, and Table 2 contains the equipment listing.

Table 1. Interoperability Status Summary

Dell PowerVault MD3000		
Functional Category	**Requirement**	**Verified**
Base IPv6	M	Yes
IPSec	S+	No
Transition Mechanisms	S	Yes
Quality of Service	O	No
Mobility	CS	No
Bandwidth Limited Networks	O	No
Host	S	No

LEGEND:

CM	Conditional Must	N/R	Not Required
IPSec	Internet Protocol Security	S	Should
IPv6	Internet Protocol Version 6	S+	Should Plus
M	Must	O	Optional

NOTE: The terms Must, Conditional Should, Should, Should Plus, and Optional are used to reference specific required Request for Comments from the Internet Engineering Task Force, the Department of Defense Information Technology Standards Registry, and the Department of Defense Internet Protocol Version 6 Generic Test Plan.

Table 2. Equipment Listing

Dell PowerVault MD3000		
Component	**Firmware/Software**	**Interface**
Dell PowerVault MD3000	Modular Disk Storage Manager V 03.35.G6.37	RJ45 Gigabit Ethernet
Dell PowerVault MD3000	CFW 07.35.22.60	SAS

LEGEND:

CFW	Controller Firmware	SCSI	Small Computer System Interface
RJ	Registered Jack	V	Version
SAS	Serial Attached SCSI		

5. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to IPv6 Capable testing is on the UC APL at http://jitc.fhu.disa.mil/adv_ip/register/register.html.

6. The JITC point of contact is Donald L. Hann, DSN 879-5130, commercial (520) 538-5130, or e-mail: don.hann@disa.mil.

FOR THE COMMANDER:

2 Enclosures a/s

for RICHARD A. MEADOR
Chief
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ADDITIONAL REFERENCES

(c) Department of Defense (DoD) Information Technology Standards Registry (DISR), "DoD Internet Protocol Version 6 (IPv6) Standard Profiles for IPv6 Capable Products Version 2.0," 1 August 2007
(d) Joint Interoperability Test Command, "DoD IPv6 Generic Test Plan Version 3," August 2007
(e) DoD Chief Information Officer (CIO) Memorandum, "IPv6," 9 June 2003
(f) DoD CIO Memorandum, "IPv6 Interim Transition Guidance," 29 September 2003
(g) DoD IPv6 Transition Office, "DoD IPv6 Master Test Plan, Version 2," September 2006
(h) DoD, "DISR Global Information Grid (GIG) Convergence Master Plan (GCMP), Version 5.25," 29 March 2006

INTERNET PROTOCOL VERSION 6 CAPABLE TESTING SUMMARY

1. SYSTEM TITLE. The Dell PowerVault MD3000 storage array running the Modular Disk Storage Manager Version 03.35.G6.37 and Controller Firmware Version 07.35.22.60, hereafter referred to as the device under test (DUT).

2. PROPONENT. Department of Defense (DoD) Internet Protocol (IP) Version 6 (IPv6) Transition Office (DITO).

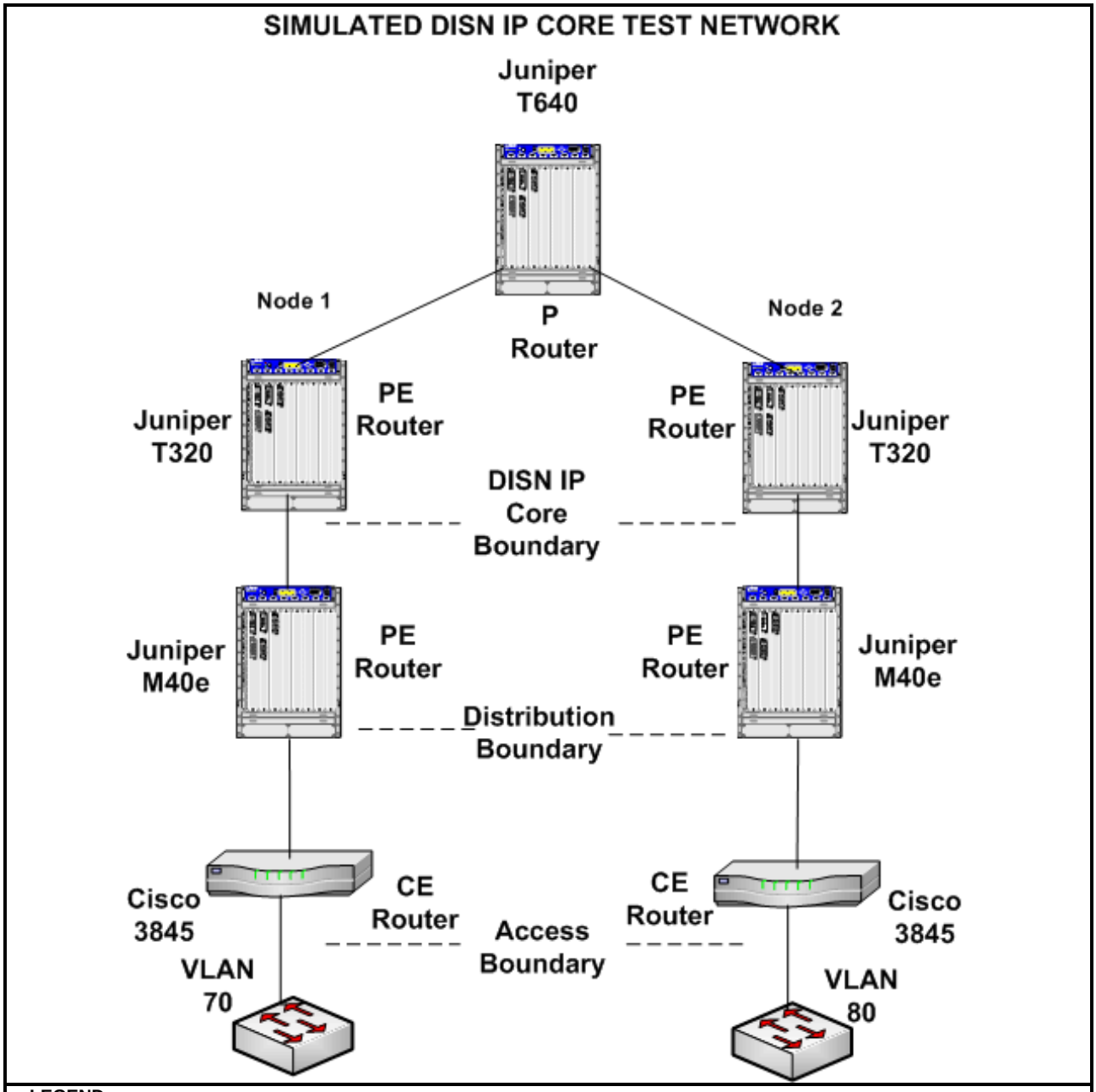
3. PROGRAM MANAGER/USER POC. DITO, Defense Information Systems Agency (DISA), Attn: GE36 Sam Assi, P.O. Box 4502, Arlington, VA 22204-4502, (703) 882-0241, e-mail: sam.assi@disa.mil.

4. TESTER. Donald L. Hann, Joint Interoperability Test Command (JITC), P.O. Box 12798, Fort Huachuca, AZ 85670-2798, DSN: 879-5130, commercial: (520) 538-5130, e-mail: don.hann@disa.mil.

5. DEVICE UNDER TEST DESCRIPTION. The DUT is a 3U rack-mounted external Redundant Array of Independent Disks storage enclosure that is capable of accommodating up to 15 Serial Attached Small Computer Systems Interface (SAS) or Serial Advanced Technology Attachment disk drives and supporting up to four hosts via 3.0 Gigabit per second SAS connections.

6. OPERATIONAL ARCHITECTURE. The operational architecture was the JITC simulated Defense Information Systems Network (DISN) IP Core Network as depicted in Figure 2-1.

7. REQUIRED DEVICE INTERFACES. All IPv6-capable products to be included on the Unified Capabilities Approved Product List must meet the requirements of the DoD Information Technology Standards Registry (DISR), “DoD IPv6 Standard Profiles for IPv6 Capable Products Version 2.0,” 1 August 2007. Product testing conducted against these requirements is in accordance with the “DoD IPv6 Generic Test Plan (GTP) Version 3,” August 2007. The IPv6 Network Appliance profile requirements for conformance and interoperability are in Table 2-1.



LEGEND:

CE	Customer Edge	LAN	Local Area Network
DISN	Defense Information Systems Network	P	Provider
IP	Internet Protocol	PE	Provider Edge
JITC	Joint Interoperability Test Command	VLAN	Virtual LAN

Figure 2-1. JITC Simulated DISN IP Core Network

Table 2-1. IPv6 Capability Requirements and Status

Dell PowerVault MD3000							
RFC	RFC Title	Testing Completed		Network Appliance		Implemented	Comments
		Conformance	Interoperability	Requirement	Met/Not Met		
IPv6 Base							
2460	Internet Protocol version 6 (IPv6) Specification	Stated in LoC	Yes	M	Met	Yes	
4443	Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification	Stated in LoC	Yes	M	Met	Yes	
2461	Neighbor Discovery for IP version 6 (IPv6)	Stated in LoC	Yes	M	Met	Yes	
1981	Path Maximum Transmission Unit Discovery for IPv6	Not Stated	Not Tested	S	Not Tested	No	
2462	IPv6 Stateless Address Auto configuration	Stated in LoC	Yes	M	Met	Yes	Note 1
3315	DHCPv6 (Client)	Not Stated	Not Tested	M	Not Tested	No	Note 1
4291	IPv6 Addressing Architecture	Stated in LoC	Yes	M	Met	Yes	
4007	IPv6 Scoped Address Architecture	Stated in LoC	Yes	M	Met	Yes	
4193	Unique Local IPv6 Unicast Addresses	Stated in LoC	Yes	M	Met	Yes	
2710	Multicast Listener Discovery (MLD)	Stated in LoC	Yes	M	Met	Yes	
3810	Multicast Listener Discovery Version 2 (MLDv2) for IPv6	Not Stated	Not Tested	S	Not Tested	No	
2464	Transmission of IPv6 Packets over Ethernet Networks	Stated in LoC	Yes	CM	Not Tested	Yes	
IPSec							
4301	Security Architecture for the Internet Protocol	Not Stated	Not Tested	S+	Not Tested	No	
4302	IP Authentication Header	Not Stated	Not Tested	S	Not Tested	No	
4303	IP Encapsulating Security Payload (ESP)	Not Stated	Not Tested	S+	Not Tested	No	
4304	Extended Sequence Number (ESN) Addendum to IPsec Domain of Interpretation (DOI) for Internet Security Association and Key Management Protocol (ISAKMP)	Not Stated	Not Tested	S	Not Tested	No	
4305	Cryptographic Algorithm Implementation Requirements for Encapsulating Security Payload (ESP) and Authentication Header (AH)	Not Stated	Not Tested	S+	Not Tested	No	
4869	Suite B Cryptographic Suites for IPsec	Not Stated	Not Tested	S+	Not Tested	No	
4309	Using Advanced Encryption Standard (AES) CCM Mode with IPsec Encapsulating Security Payload (ESP)	Not Stated	Not Tested	CS	Not Tested	No	

Table 2-1. IPv6 Capability Requirements and Status (continued)

Dell PowerVault MD3000							
RFC	RFC Title	Testing Completed		Network Appliance		Implemented	Comments
		Conformance	Interoperability	Requirement	Met/Not Met		
3971	Secure Neighbor Discovery	Not Stated	Not Tested	S	Not Tested	No	
3972	Cryptographically Generated Addresses	Not Stated	Not Tested	S	Not Tested	No	
3041	Privacy Extensions for Stateless Address Auto configuration in IPv6	Not Stated	Not Tested	S	Not Tested	No	
4306	Internet Key Exchange (IKEv2) Protocol	Not Stated	Not Tested	S+	Not Tested	No	
4307	Cryptographic Algorithms for Internet Key Exchange Version 2 (IKEv2)	Not Stated	Not Tested	S+	Not Tested	No	
Transition Mechanisms							
4213	Transition Mechanisms for IPv6 Host and Routers	Stated in LoC	Yes	S	Met	Yes	
2766	Network Address Translation – Protocol Translation (NAT-PT)	Not Stated	Not Tested	SN	Not Tested	No	
3053	IPv6 Tunnel Broker	Not Stated	Not Tested	CS	Not Tested	No	
QoS							
2474	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers	Not Stated	Not Tested	O	Not Tested	No	
2205	Resource ReSerVation Protocol (RSVP) – Version 1 Functional Specification	Not Stated	Not Tested	O	Not Tested	No	
2207	RSVP Extensions for IPSEC Data Flows	Not Stated	Not Tested	O	Not Tested	No	
2210	The Use of RSVP with IETF Integrated Services	Not Stated	Not Tested	O	Not Tested	No	
2750	RSVP Extensions for Policy Control	Not Stated	Not Tested	O	Not Tested	No	
3175	Aggregation of RSVP for IPv4 and IPv6 Reservations	Not Stated	Not Tested	O	Not Tested	No	
Mobility							
3775	Mobility Support in IPv6	Not Stated	Not Tested	CS	Not Tested	No	
4282	The Network Address Identifier	Not Stated	Not Tested	CS	Not Tested	No	
4283	Mobile Node Identifier for Option for IPv6	Not Stated	Not Tested	CS	Not Tested	No	
Bandwidth Limited Networks							
3095	Robust Header Compression (RoHC)	Not Stated	Not Tested	O	Not Tested	No	
3241	RoHC over PPP	Not Stated	Not Tested	O	Not Tested	No	
3843	RoHC: A Compression Profile for IP	Not Stated	Not Tested	O	Not Tested	No	
4362	RoHC: A Link-Layer Assisted Profile for IP/UDP/RTP	Not Stated	Not Tested	O	Not Tested	No	
2507	IP Header Compression	Not Stated	Not Tested	O	Not Tested	No	
2508	Compressing IP/UDP/RTP Headers for Low-Speed Serial Links	Not Stated	Not Tested	O	Not Tested	No	

Table 2-1. IPv6 Capability Requirements and Status (continued)

Dell PowerVault MD3000							
RFC	RFC Title	Testing Completed		Network Appliance		Implemented	Comments
		Conformance	Interoperability	Requirement	Met/Not Met		
Host							
3484	Default Address Selection for IPv6	Not Stated	Not Tested	S	Not Tested	No	
3596	DNS Extensions to Support IPv6	Not Stated	Not Tested	S	Not Tested	No	
3986	Uniform Resource Identifier (URI): Generic Syntax	Not Stated	Not Tested	S	Not Tested	No	

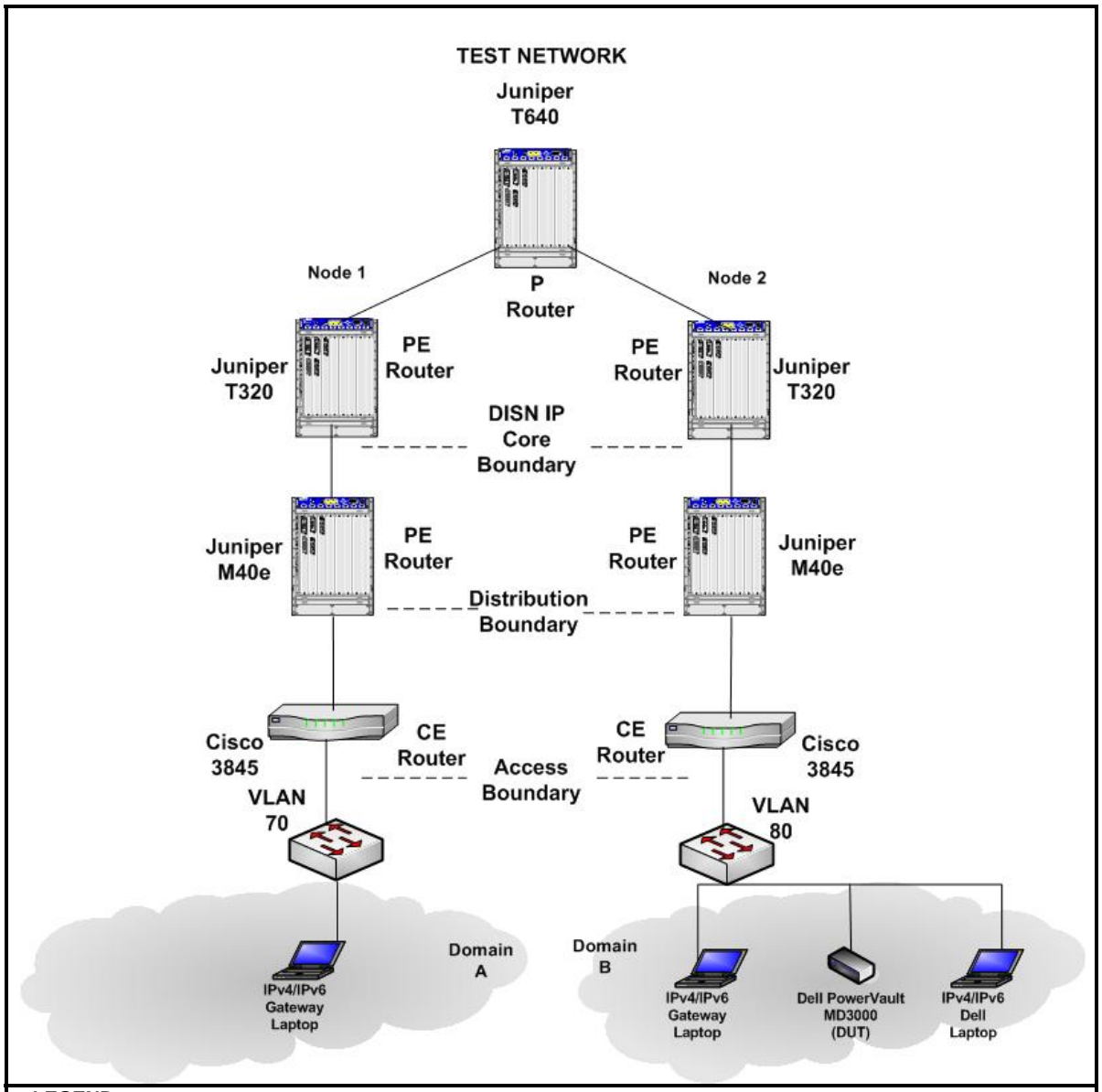
LEGEND:

CBC	Cipher Block Chaining	M	Must
CCM	CBC MAC Mode	MAC	Message Authentication Code
CM	Conditional Must	O	Optional (May)
CS	Conditional Should	PPP	Point-to-Point Protocol
DHCPv6	Dynamic Host Configuration Protocol Version 6	QoS	Quality of Service
DNS	Domain Name Service	RFC	Request for Comment
DoD	Department of Defense	RoHC	Robust Header Compression
FC	Fiber Channel	RSVP	Resource ReSerVation Protocol
HTTP	Hypertext Transfer Protocol	RTP	Real-Time Transport Protocol
IETF	Internet Engineering Task Force	S	Should
IP	Internet Protocol	S+	Should+
IPSec	Internet Protocol Security	SN	Should Not
IPv4	Internet Protocol Version 4	SLAAC	Stateless Address Auto-configuration
IPv6	Internet Protocol Version 6	UDP	User Datagram Protocol
LoC	Letter of Conformance		

NOTES:

1. The device must implement one of the automatic configuration mechanisms SLAAC or DHCPv6.
2. The terms Must, Conditional Must, Should, Should Plus, Conditional Should, Should Not, and Optional are used to reference specific required RFCs from the IETF, the DoD Information Technology Standards Registry, and the DoD IPv6 Generic Test Plan.

8. TEST NETWORK DESCRIPTION. The DUT was tested as part of the JITC simulated DISN IP Core Network managed by the Advanced IP Technology Capability, and configured as shown in Figure 2-2.



LEGEND:

CE	Customer Edge	IPv6	IP Version 6
DISN	Defense Information Systems Network	P	Provider
DUT	Device Under Test	PE	Provider Edge
IP	Internet Protocol	VLAN	Virtual Local Area Network
IPv4	IP Version 4		

Figure 2-2. Dell Test Network

9. DEVICE CONFIGURATIONS. Table 2-2 provides hardware and software components used in the Dell test network.

Table 2-2. Dell Test Configuration Hardware and Software

Equipment Name	Model Number	IOS/OS/Version(s)
Hardware		
Dell Storage Array - DUT	PowerVault MD3000	MDSM V 03.35.G6.37/CFW V 07.35.22.60
2 Cisco Routers	Cisco 3845	12.4(11)T
2 Juniper Routers	Juniper M40e	V 7.6R3.6
2 Juniper Routers	Juniper T320	V 7.5R4.4
Juniper Router	Juniper T640	V 7.5R4.4
2 Gateway Notebooks	450ROG	Microsoft Windows XP Professional SP1
Dell Notebook	Latitude	Windows XP Professional SP3
Software		
MS Windows XP Professional	N/A	V 5.1.2600, SP1 Build 2600
MS Windows XP Professional	N/A	V 5.1.2600, SP3 Build 2600
Wireshark	N/A	V 1.0.3 (SVN Rev 26134)

LEGEND:

CFW	Controller Firmware	R	Release
DUT	Device Under Test	Rev	Revision
IOS	Internetworking Operating System	SP	Service Pack
MDSM	Modular Disk Storage Manager	SVN	Software Version Number
N/A	Not Applicable	T	New Technology
OS	Operating System	V	Version

10. TEST LIMITATIONS. None.

11. TEST RESULTS.

a. IPv6 Base.

Test Case C.1.2. The Request for Comments (RFC) 2460 IPv6 Specification is the base specification of the IPv6 protocol. It specifies a number of parameters that enable successful completion of IPv6 traffic addressing and control. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.14. The RFC 4443 Internet Control Message Protocol (ICMP) for the IPv6 specification identifies ICMP messages for the IPv6 protocol. It includes message format and identifies two types of messages: error and informational. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.3. The RFC 2461 Neighbor Discovery for IPv6 specifies the neighbor discovery function that is similar to address resolution protocol in IP Version 4 (IPv4). It is necessary for implementing neighbor solicitations and neighbor advertisements within IPv6. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.4. The RFC 2462 IPv6 Stateless Address Auto-configuration specifies how a host auto-configures its interfaces in IPv6. These steps include determining whether the source addressing should be stateless or stateful, whether the information obtained should be solely the address or include other information, and whether Duplicate Address Detection identifies duplicate addresses on the network, and then issues a new address accordingly. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.13. The RFC 4291 IPv6 Addressing Architecture defines the specifications for the addressing architecture of the IPv6 protocol. The definitions cover unicast addresses, anycast addresses, and multicast addresses. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.11. The RFC 4007 IPv6 Scoped Address Architecture defines the nature and characteristics for the usage of IPv6 addresses of different scopes. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.12. The RFC 4193 Unique Local IPv6 Unicast Addresses defines globally unique local addresses. Local IPv6 unicast addressing is intended to be used for local communications and is not expected to be routed to the internet. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.8. The RFC 2710 Multicast Listener Discovery for IPv6 specifies the protocol used by an IPv6 router to discover the presence of multicast listeners (i.e., nodes wishing to receive multicast packets) on its directly attached links, and to discover specifically which multicast addresses are of interest to those neighboring nodes. The Dell PowerVault MD3000 met the test requirement.

Test Case C.1.5. The RFC 2464 Transmission of IPv6 Packets over Ethernet Networks specifies the frame format for transmission of IPv6 link-local addresses and statelessly auto-configured addresses on Ethernet networks. The Dell PowerVault MD3000 met the test requirement.

b. Transition Mechanisms.

Test Case C.3.18. The RFC 4213 Transition Mechanisms for IPv6 specifies IPv4 compatibility mechanisms that can be implemented by IPv6 hosts and routers. These mechanisms include providing complete implementations of both versions of the IP (IPv4 and IPv6), and tunneling IPv6 packets over IPv4 routing infrastructures. The Dell PowerVault MD3000 met the test requirement.

c. Conclusion. The Dell PowerVault MD3000 met all the required RFCs.

12. TEST AND ANALYSIS REPORT. All test data is maintained in the Advanced IP Technology Capability and is available upon request. This certification is available on the Joint Interoperability Tool (JIT). The JIT homepage is http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125/ (SIPRNet). The JIT has links to JITC interoperability documents to provide the DoD community, including the warfighter in the field, easy access to the latest interoperability information. System interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/.gov users on the NIPRNet at: https://stp.fhu.disa.mil/.